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WINTER STUDIES OF CERVIDS IN THE VALLEYS OF THE OLDMAN RIVER AND ITS TRIBUTARIES 1985-86

SALIX ENTERPRISES LTD.

WINTER STUDIES OF CERVIDS IN THE VALLEYS OF THE OLDMAN RIVER AND ITS TRIBUTARIES 1985-86

a report prepared for

ALBERTA ENVIRONMENT PLANNING DIVISION

by

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July 20, 1986

EXECUTIVE SUMMARY

The purpose of this study was to continue to study cervid populations wintering in the valleys of the Oldman, Crowsnest and Castle Rivers during 1985-86. The study began November 5, 1985, and was completed by the end of March, 1986. The study area included segments of the river valley to be included in the planned reservoir, segments of the three rivers upstream of the reservoir, part of the Oldman River valley below the damsite, and specified foothills wintering areas. Methods of collecting data included aerial surveys, ground reconaissance, and foot surveys.

The river valleys to be flooded by the planned dam provide important wintering habitat for mule deer, particularly those locations that provide shelter from prevailing southwest winds. White-tailed deer are found outside the reservoir area in winter, perhaps because of the rough terrain it encompasses.

Numbers of mule deer using the river valleys within the reservoir area as winter range are thought to be higher than the numbers using it yearlong. The minimum number of mule deer using the reservoir area in summer, including fawns, was estimated at 220. In the winter of 1985-86, the estimated number of mule deer associated with the area to be influenced by the reservoir was 350 to 400 animals. A few white-tailed deer occurred in the reservoir area in summer, but none were seen in winter.

Production and survival of fawns in the population of mule deer appeared to be high. Late winter classification counts resulted in ratios of 69 fawns to 100 adults.

All observations of deer were plotted on vegetation maps prepared for Alberta Environment. Mule deer tended to select shrubby areas and Douglas fir. Large numbers of the observations were of deer in open grassland. The deer seemed to use cottonwood habitats much more extensively in summer than winter. A major difference in habitat use between the two winters studied was greater use of cultivated areas in the winter of 1984-85 than 1985-86. In contrast to the mule deer, white-tailed deer in winter were seen in only two habitat types - grassland and cottonwoods. Observations of white-tailed deer in summer were too few to draw any conclusions.

Common features of the river valley used by mule deer as winter range were identified as topographic shelter, vegetative cover, food and the absence of large numbers of cattle (Allison and Russell 1985). To that list this year is added topographic relief or rough terrain.

Use of browse plants in the study area in 1984-85 was found to be high in comparison with findings of other studies. Levels of browsing in the present study were similar to the previous winter and to a control plot counted in Waterton Park.

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A. INTRODUCTION

The Government of Alberta is currently proceeding with its plans to dam the Oldman River and fill a reservoir that will flood the valleys of the Crowsnest, Oldman and Castle Rivers.

The flooding of the reservoir will remove yearlong and wintering habitat for populations of mule deer, and will also affect local and area populations of other cervids. In the winter of 1985-86 Alberta Environment commissioned a study to continue monitoring the numbers and distribution of cervids in and near the proposed reservoir area.

The Oldman River in the study area provides a link between prairie and mountain habitats for wildlife. Winter and summer studies done for Alberta Environment by Salix Enterprises Ltd. (Allison and Russell 1985, Young et al. 1986) indicate that the river valley in the area of the reservoir is used winter and summer by numbers of mule deer. White-tailed deer were found to occur with mule deer upstream of the reservoir on all tributary rivers as well as downstream of the damsite. Only a few individual white-tailed deer were seen within the reservoir.

The area that will be filled by the reservoir appears to offer winter shelter to mule deer that move into the area at that time as well as yearlong habitat for a smaller number of mule deer and summer range for a few white-tailed deer. The thick vegetative shelter along the river and on islands is excellent fawning habitat; and a combination of topographic shelter, vegetative cover, food, and absence of large numbers of cattle makes many sites in the valley attractive to deer in winter (Allison and Russell 1985, Young et al. 1986).

B. OBJECTIVES

The objective of the present study was to continue to assess the importance of the valleys of the Oldman, Crowsnest and Castle rivers to cervids. The study was intended to supplement and confirm the results of previous work done for Alberta Environment (Allison and Russell 1985, Young et al. 1986) and determine the extent to which any changes in conditions from one year to the next influence the use of the reservoir area by deer. The Terms of Reference (Appendix 1) specifically stated the objectives:

1) To determine the species and population size of the ungulates using the reservoir and adjacent areas during the winter,
2) To determine the distribution and movements of these populations.
3) To document fall numbers and distributions of ungulates in summering areas near the river valley, if early snowfall permits.

C. THE STUDY AREA

The three rivers affected by the planned Oldman dam - the Oldman, Castle and Crowsnest - lie in a region of highly variable weather conditions in the southwestern part of Alberta, roughly 80 km north of the Montana border and 50 km from British Columbia. The study area sits within the Fescue Grass Ecoregion and borders the Montane Ecoregion. As a result, it is an area of high biotic diversity. The Three Rivers area has been described by several authors, and detailed descriptions of the vegetation and wildlife in the area are available in studies commissioned by Alberta Environment Planning Division, particularly Allison and Russell (1985), Hardy Associates (1978) Ltd. (1986), and Young et al. (1986).

D. METHODS

The study area was defined by Alberta Environment and was identical to the area surveyed in 1984-85. It included the areas to be flooded by the Oldman reservoir and parts of the river valleys upstream and downstream of the reservoir. The river valleys were divided into segements to conform with Alberta Fish and Wildlife survey areas. Browse surveys were done at 12 locations (Figure 1).

1. Aerial Survey

Helicopter surveys were conducted from elevations of 120 to 180 meters above ground level. An air speed near 100 kph was maintained, except during periods of strong wind. The helicopter used was a Bell 206B.

All survey personnel have extensive aerial survey experience; the same observers who did the work in 1984-85 participated in the surveys of 1985-86.

The surveyors attempted to count all deer in the study area on each survey. Transect techniques were considered inappropriate because of the small size of the study area and its great topographic variability. When groups of deer were encountered, the helicopter circled the area so that the animals could be counted individually. All observations were recorded on maps at a scale of 1:50,000, and later plotted on the photomosaic. When farm sites were encountered, the survey line was altered to avoid flying over buildings or livestock, which may have caused some deer to be missed. On one survey, numbers of cattle using the river valley in the reservoir area were estimated, but no attempt was made to count individual animals in each group.

Figure 1. The Study Area, showing river segments and Foothills survey blocks (determined by Alberta Environment and Fish and Wildlife Division), plus ground survey locations.

River segments included in the reservoir:

OM - 25b
OM - 26
OM - 27
OM - 28
C - 1
CR - 1

River segments upstream of the reservoir:

OM - 29
C - 2
CR - 2

River segments downstream of the reservoir:

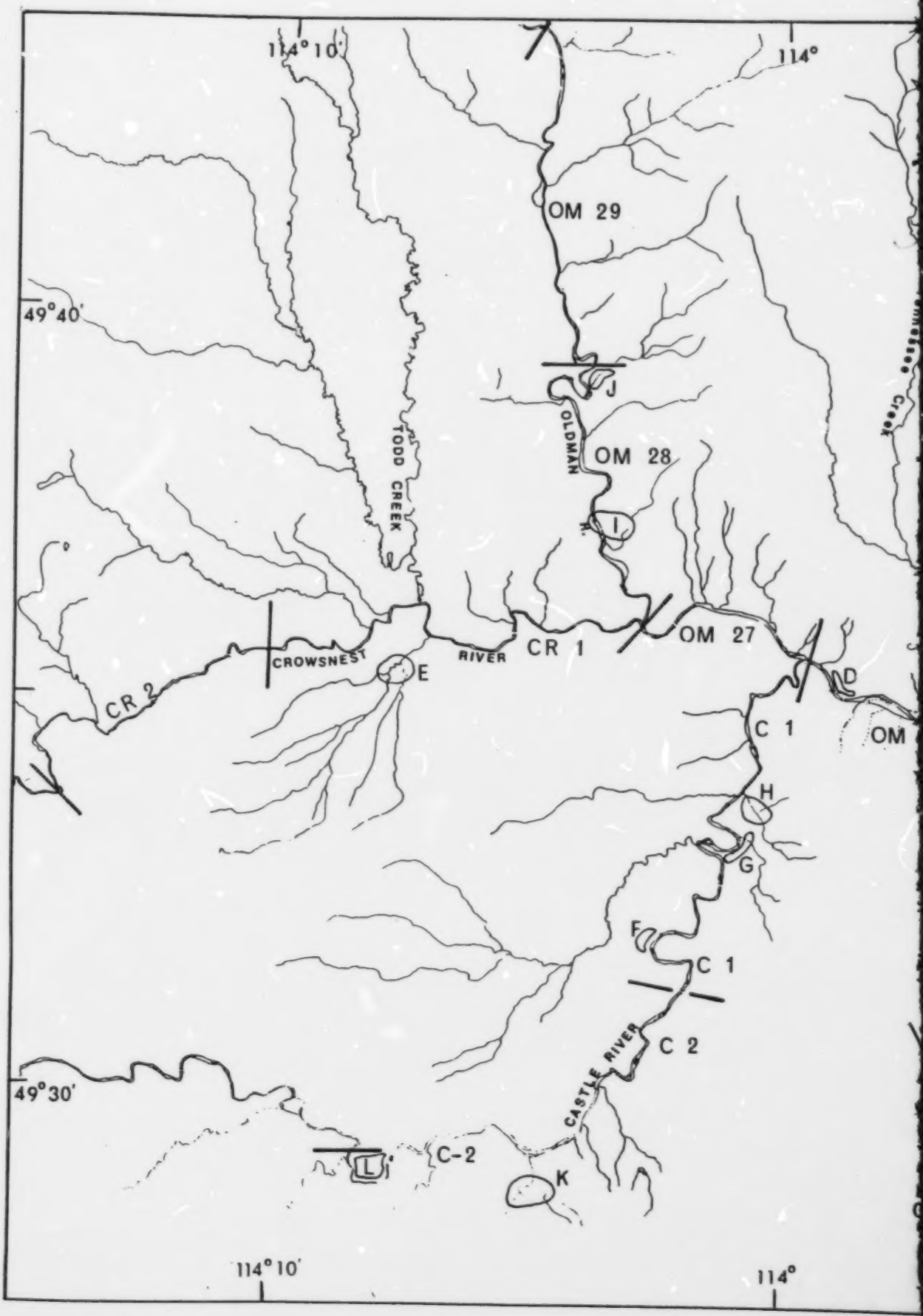
OM - 24
OM - 25a

Foothills survey areas:

FH - 1
FH - 2
FH - 10

Browse survey areas:

A to L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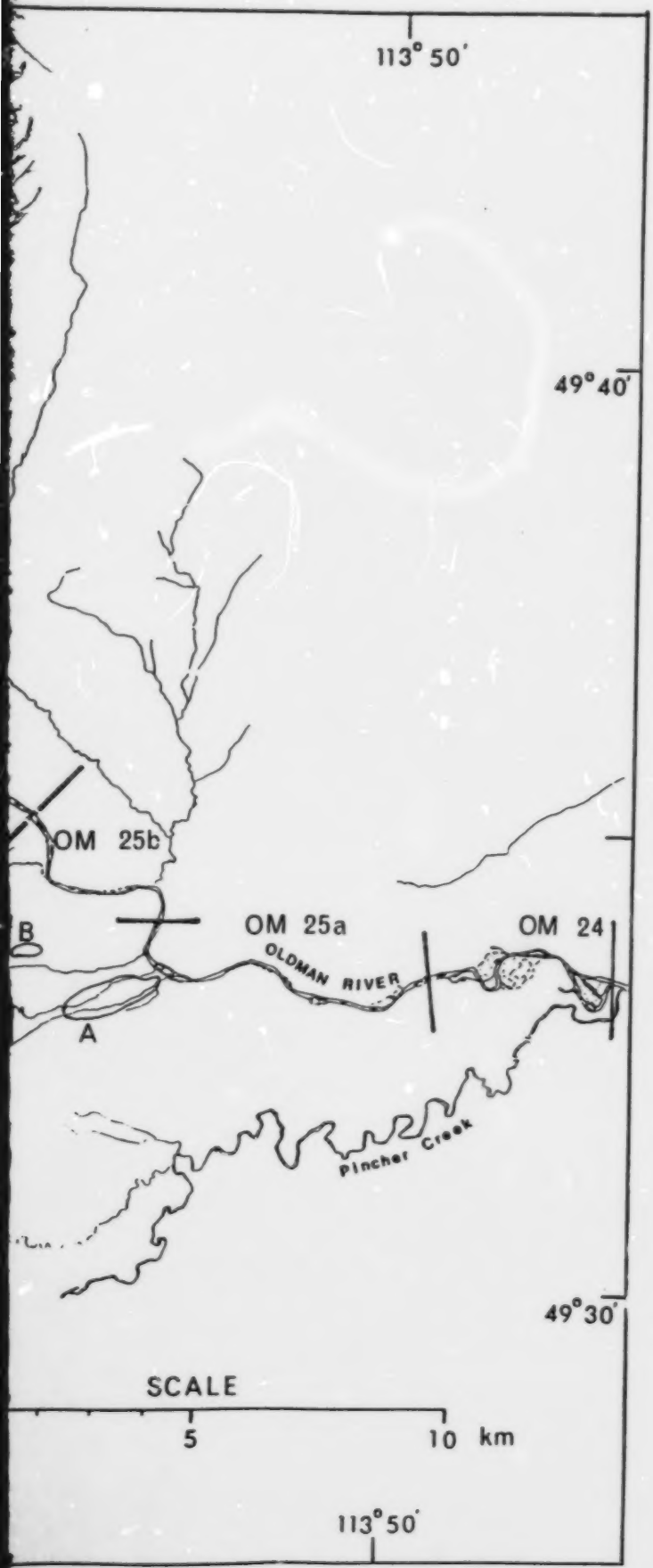
114°
OM 29
49° 40'
J
OLDMAN
OM 28
TODD CREEK
I
CROWSNEST
RIVER
CR 1
OM 27
CR 2
E
D
C 1
OM
H
G
F
C 1
C 2
CASTLE RIVER
49° 30'
C-2
L
K
114° 10'
114°



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River segments downstream of the reservoir:

OM - 24
OM - 25a

Foothills survey areas:

FH - 1
FH - 2
FH - 10

Browse survey areas:

A to L

Foothills survey blocks were crossed in lines roughly parallel to the direction of major ridges. Total coverage of the area and complete counts of the cervids were attempted. The foothills ranges were covered completely only in November, before the movement of deer to the winter range. Inclement weather conditions prevented surveys of the foothills on the later flights.

The techniques used are considered comparable to those of L. Gudmundson (pers. comm. 1985) in previous surveys conducted for the Fish and Wildlife Divison, Alberta Energy and Natural Resources. They are also consistent with those used by the study team during its earlier study in the winter of 1984-85.

2. Classification of Deer

Classification of the area population by age and sex was done from the ground using a 20-45 X spotting scope and binoculars. Animals were located by driving along roads in the area or hiking in areas known to support relatively high densities of deer. Once they were located, an attempt was made to get close enough to distinguish age and sex characteristics. Deer observed during browse surveys that were from groups known not to have been included in the earlier classifications were classified when possible. Classification counts were begun February 14 and completed February 27.

Mule deer were classified as does, bucks or fawns based on body size and facial characteristics. Some bucks retained antlers in late winter, but the classification counts relied upon distinctive markings on the faces of males to distinguish them from females. Fawns could be identified by the relatively shorter length of the face and a smaller body size than adults.

3. Browse Survey

Browse surveys begun in 1985 were repeated in late winter 1986 using the same techniques. A count of browsed twig ends was made at twelve sites, including all sites sampled in 1985 and some additional locations.

Browse use was calculated by randomly choosing five stems of each species in an area showing signs of use. Total tips available for browse and ends browsed were counted. A browsed tip was one with no terminal bud and usually showed a frayed end. An unbrowsed tip had a terminal leaf bud. All browse counts were done before the end of the wintering period in areas that were still used by deer. The extent of browse use should therefore be underestimated by this study.

Browsing by deer in an area could be distinguished from browsing by cattle. Cattle normally browse 100% of stems and take stems of a much larger diameter than do deer.

4. Habitat Use

All observations of deer, whether from the air or on the ground, were plotted on a mylar overlay of the vegetation analysis produced by Hardy and Associates (1978) Ltd. (1986). Observations were in three groups: late winter 1985 (from original data of Allison and Russell 1985), fall 1985, and late winter 1986. Summer observations are included, although they were also reported elsewhere (Young et al. 1986). The vegetation map in some locations did not separate small areas of brush or aspens from surrounding areas of grassland. Where deer were seen in those situations the habitat reported reflects the actual vegetation type in which the deer were seen, rather than the vegetation type recorded

on the photomosaic.

5. Waterton Dam Comparison

The Waterton dam is on the Waterton River southeast of Pincher Creek. The reservoir formed behind it is used to supply water to the St. Mary's dam reservoir, and ultimately to irrigation farms in the Lethbridge area. It is an established dam, more than twenty years old. The study team surveyed upstream of the reservoir, downstream of the dam and around the reservoir on foot to determine the extent to which the area is currently used by deer.

D. RESULTS

1. Aerial Surveys

During the study, three aerial surveys were done: November 5, 1985; January 21, 1986; and February 20, 1986. In comparison, only a single survey was possible the previous winter. Weather conditions during both winters allowed few opportunities to conduct effective surveys.

The November 5 survey was conducted the day prior to the opening of the hunting season in the area. There was 15 cm of new snow on the ground. Wind speeds at ground level were about 15 kph when the survey began and 50 kph at the end. Fresh snow clung to the shrubs and deer tended to remain in their beds in cover throughout the survey. The survey covered both river and foothills portions of the study area and parallel sections of Todd Creek.

On January 21, fresh snow 5 to 10 cm in depth covered the ground, and again remained on trees and shrubs, reducing visibility of the deer from the helicopter. Although there was no wind and the weather was warm (above 0 C), the deer remained sheltered under trees and seemed reluctant to move. The flight failed to locate many deer that were observed from the ground the previous day and was terminated after completing the river portions of the survey.

The February 20 survey followed a 53 cm snowfall that had settled to 42 cm at the time of the survey (Pincher Creek Weather Station pers. comm.). Three days of intense cold (-35 C) moderated to temperatures around -10 C. Tracks left in the deep

snow made it easy to locate areas of deer activity, and those could be searched for deer. A moderate wind caused slight drifting when the survey began, but wind speeds increased to 60 kph with heavy drifting and turbulence by the time the survey ended. The deteriorating weather conditions prevented surveys of the foothills study blocks.

Observations of deer from survey to survey varied (Table 1, Appendix 2).

Table 1. Observations of Deer during Survey Flights 1985-86

DATE	RIVER		NON RIVER	
	Reservoir	Non-reservoir	Foothills	Todd Creek
Nov 5				
MD	208	125	92	85
OTHER	5WT,3M	3WT	15WT,9E,5M	
Jan 21				
MD	161	39	-	-
OTHER	0	25WT		
Feb 21				
MD	279	119	-	0
OTHER		113WT		

MD mule deer, WT white-tailed deer, E elk, M moose

The January survey was done one day after a snowfall, during which a ground reconaissance was done by truck. This partial coverage of the study area resulted in observations of 191 mule deer. Because we could not find all these animals from the air, or locate tracks leaving the area, and because the deer were difficult to see, we concluded that they were present but not observed during the flight. The November and February surveys are considered to be more accurate.

During each survey, observations of species other than cervids were recorded. Numbers of coyotes seen varied from three to six,

in contrast to the nineteen observed in 1985. Small numbers of bald eagles and golden eagles were observed. On the February survey a gyrfalcon, two prairie falcons, a great horned owl, and about 300 ducks, primarily mallards, were observed.

In January observers estimated the numbers of domestic animals sharing the shelter of the reservoir area. Rough counts of domestic animals seen in the reservoir area were: 1526 cattle, 100 sheep and 15 horses. Most of the cattle and sheep were in feed lots or small pastures near farmsteads.

2. Productivity Estimates

Estimates of productivity and recruitment to deer populations can be determined by two methods. Either 1/2 of the number of fawns in the fall is expressed as a ratio to 100 does or the number of fawns in late winter is expressed as a ratio to 100 adults (Connolly 1981).

Classification counts were accomplished as late in the season as the terms of the contract could allow. One hundred thirty different mule deer were classified. The 69 does, 53 fawn and 8 bucks resulted in a ratio of 69 fawns:100 adults or 40.8% fawns in the total late winter population of mule deer. Because sample sizes were small, the figures are subject to error. However, it appears that fawn production and survival in the mule deer population in the area was high.

3. Distribution of Deer

All sightings of deer during both winters of the study were

plotted on a single map (Figure 2), and all sightings during summer and fall on another (Figure 3). November observations were considered with summer because the deer remained on their summer ranges at that time (personal observation). Examination of the two maps points out major differences in distribution between seasons. During the summer, deer are in small groups and spread throughout the entire river valley. In winter, by contrast, almost all observations are clumped within certain parts of the river valley (Figures 2, 3). The lack of summer observations at the extreme ends of the study area is a reflects the smaller study area used in the summer program (Young et al. 1986).

Wintering areas within the reservoir used by mule deer include: (1.) the valley and large coulees immediately below the damsite, the river valley above the dam and lower Tennessee Creek; (2.) Castle River from two km upstream of its junction with the Oldman to the top of the reservoir area, (3.) the north fork of the Oldman River at the upper end of the reservoir, and (4.) lower Todd Creek (Figure 2). These may be considered the most important parts of mule deer winter range within the reservoir.

Comparison of the summer and winter ranges used by mule deer in the study area shows two major differences. While all the winter ranges are used in summer, some of the summer range is effectively abandoned during winter. Those areas not used in winter include the main stem of the Crowsnest River and the Oldman River downstream of its confluence with the Crowsnest. These areas are exposed to the prevailing southwest winds and have gentle topography, unlike the wintering areas which are sheltered, steep, rough locations.

Figure 2. Winter Observations of Mule Deer in the Study Area

a - Jan. 30, 1985 aerial survey:
total number - 365
number of groups - 30
group size 1 - 70
mean group size 12.2

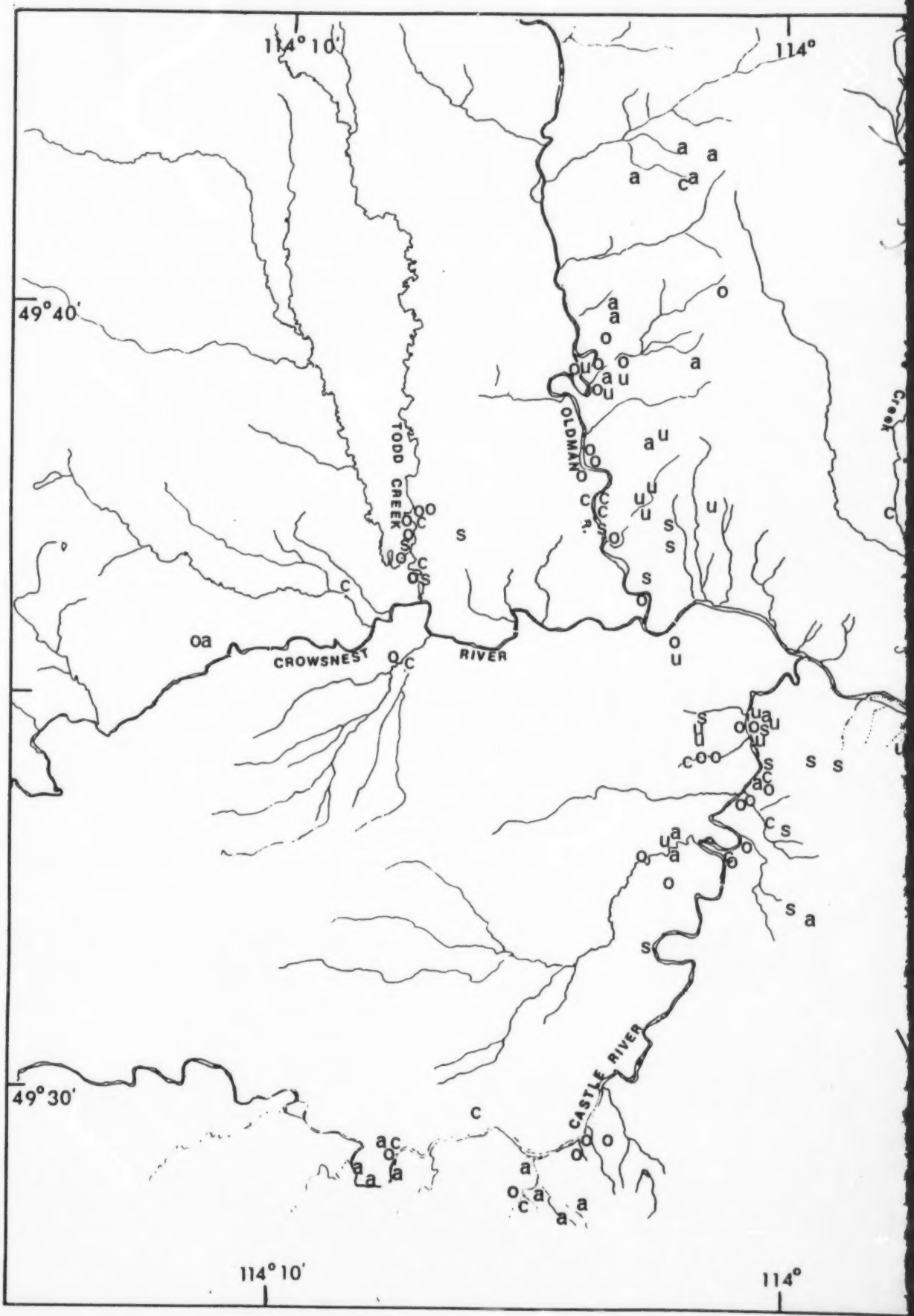
c - Jan. 21, 1986 aerial survey:
total number - 272
number of groups - 25
group size 1 - 30
mean group size 10.9

o - Feb. 20, 1986 aerial survey:
total number - 398
number of groups - 49
group size 1 - 32
mean group size 8.1

s - Winter 1985 ground surveys:
total number - 349
number of groups - 24
group size 2 - 45
mean group size 15.6

u - Winter 1986 ground surveys:
total number - 367
number of groups - 28
group size range 1 - 49
mean group size 13.4

Total winter deer sightings - 1751
total number of groups - 156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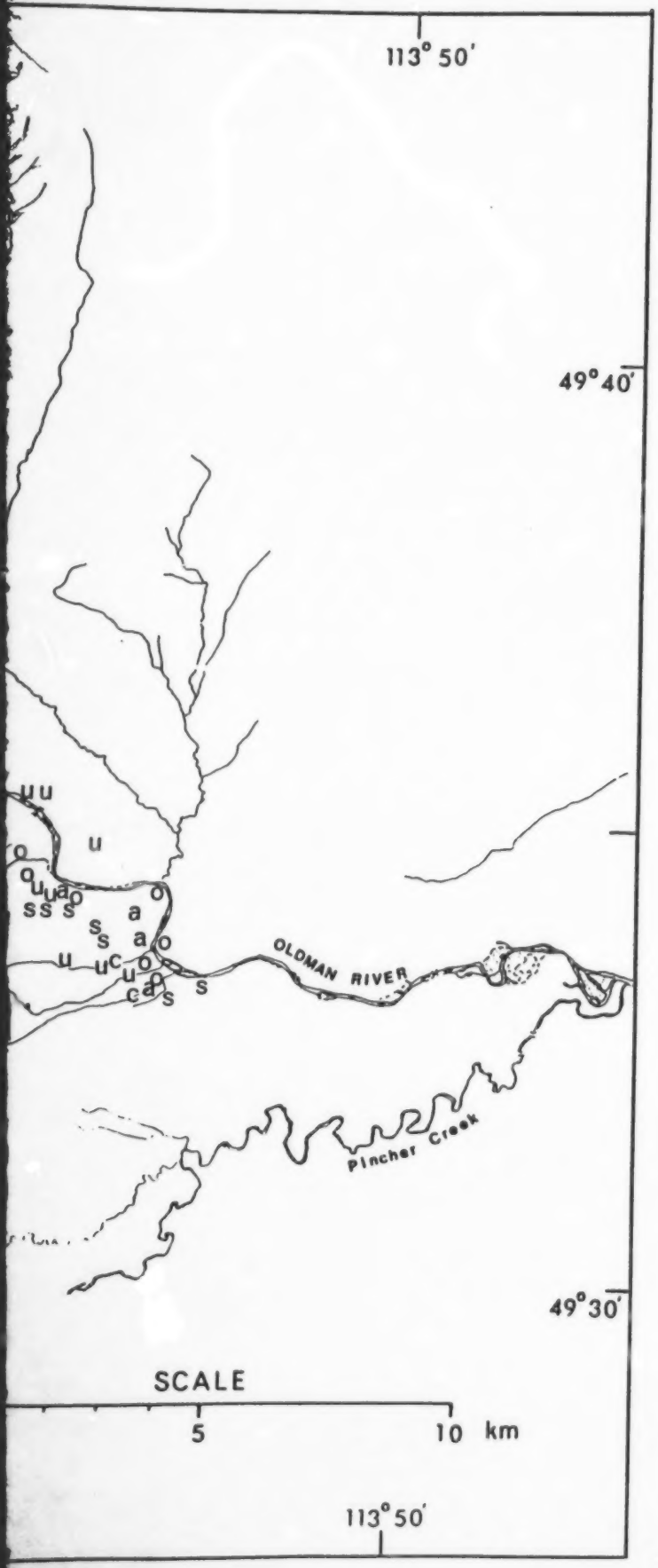
OLDMAN R.
CROWSNEST
RIVER
CASTLE RIVER
49° 30'
114° 10'
114°



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Total winter deer sightings - 1751
total number of groups - 156

Figure 3. Summer and Fall Observations of Mule Deer in the Study Area

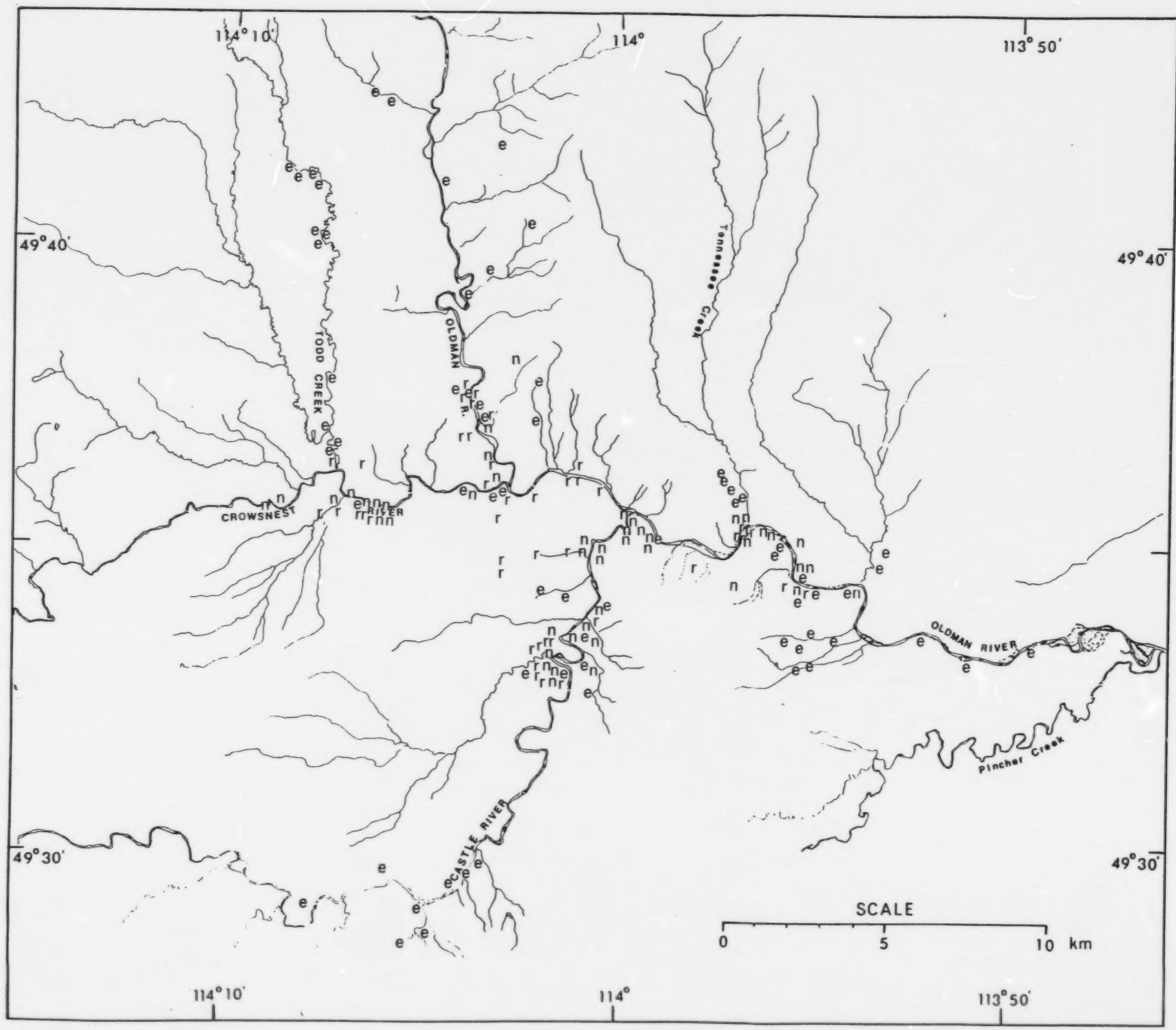
e - Nov. 5, 1986 aerial survey:
- total number - 412
- number of groups - 81
- group size range 1 - 25
- mean group size 5.1

n - summer observations June 5 - July 15, 1985:*
- total number - 126
- number of groups - 64
- group size range 1 - 6
- mean group size 2.Ø

r - summer observations July 12 - Sept. 3, 1985:
- total number - 92
- number of groups - 31
- group size range 1 - 7
- mean group size 3.Ø

Total summer mule deer sightings - 63Ø
- total number of groups 176

* data collected by Environmental Management Associates Ltd., Calgary.



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- total number - 92
- number of groups - 31
- group size range 1 - 7
- mean group size 3.0

Total summer mule deer sightings - 630
- total number of groups 176

* data collected by Environmental Management Associates Ltd., Calgary.

4. Habitat Use

Observations from both winters of study as well as the fall and summer were plotted on mylar overlays of the photographic mosaic, showing vegetation in the reservoir area (Hardy and Associates (1978) Ltd. 1986), and were summarized in tabular form (Table 2).

Table 2. Percentage of Mule Deer Observations in Various Habitats

HABITAT TYPE	WINTER 84-85	WINTER 85-86	FALL 85	SUMMER 85
1A grassland	33	34	36	31
1B grassland	2	3	Ø	3
2A shrubs	13	3Ø	3Ø	19
2B juniper	6	13	5	9
3 cottonwood	3	5	2Ø	18
4 aspen	1	4	1	7
5 limber pine	5	Ø	Ø	3
6 Douglas fir	4	8	9	5
C cultivated	33	2	Ø	5
TOTAL NO	732	1638	528	297

The eleven observations of white-tailed deer in summer included three in shrub habitat (type 2A), six in cottonwood habitat (type 3) and two in aspen (type 4). The 175 observations of white-tailed deer in winter were restricted to two habitat types: 61 deer were seen in grasslands (type 1A) and 114 deer in cottonwoods (type 3).

The variability in the habitat in the river valleys led to some difficulties in assigning deer to a specific habitat type. Many locations support a mixture of types, and that may be indicated on the photomosaic (Hardy and Associates (1978) Ltd. 1986). Where deer were observed in areas of mixed habitat or on the edges of habitat types, they were assigned to both areas. That would have the effect of somewhat overstating the importance of the

first six vegetation groups and slightly understating the use of the conifers and cultivated areas.

5. Browse Surveys

Browse surveys done by the study team in 1985-86 included sampling more sites and counting more twigs than in the 1984-85 season (Figure 1, Table 3). A site in Waterton Park was also sampled for comparative purposes (Table 3). Cattle are excluded

Table 3. Browse survey: Mean Percent of Twig Ends Removed by Deer

	SASKA-TOON	SILVER-BERRY	CHOKE-CHERRY	RED OSIER	HAW-THORN	ROSE	ASPEN
1985	65.5	47.5	87	87	-	57.3	72
no.	6	4	1	2	Ø	3	1
1986	67.9	66.6	76.5	8Ø.3	69	71.8	73
no.	2Ø	12	13	7	3	4	1
W.P.*	84		78	77			78
no.	1		1	1			1

* W.P. represents Waterton Park
no. indicates the number of samples of each species. Each sample consists of 5 stems, i.e. in 1985 there were 3Ø stems of saskatoon counted at 6 different sample sites.

from the park, and the area sampled is known to be used primarily by deer. Moose and elk are absent.

Comparison of the data between areas and between years suggests that there are not major differences among them. A more intensive look at browsing would be necessary to distinguish whether differences like those between 1985 and 1986 are statistically significant. For the purposes of this study it is adequate to point out that use of browse by deer in the study area was heavy in both years, and was similar to the pressure exerted by deer on some of the same species in Waterton Park.

E.DISCUSSION

1. Population Size and Trend

The wintering population of mule deer directly associated with the area to be influenced by the reservoir, that is, by flooding, slumping, and construction activities; but not necessarily including those affected by new road construction and changing traffic patterns is estimated to be 350 to 400 for the winter of 1985-86. Four hundred seventy-five to 575 mule deer were estimated to occupy the entire river valley study area in that winter. White-tailed deer were observed primarily upstream and downstream of the reservoir area, where their minimum numbers were 113.

The estimates for winter 1984-85 compare to estimates for the 1984-85 season in the reservoir area of 240 to 340 mule deer and 10 to 20 white-tailed deer. In the river valley portions of the study area as a whole, the estimated numbers were 400 to 530 mule deer and 70 to 80 white-tailed deer (Allison and Russell 1985). Use of the river valleys of the Oldman, Crowsnest and Castle rivers by deer is thought to be greatest in winter. Summer populations are both lower in number and more dispersed in habit (Young et al. 1986).

A few moose were present in the Crowsnest River valley in both years.

The yearlong population of mule deer in the study area in 1985 is thought to have been a minimum of 220 animals in 1985, including fawns (Appendix 2, Table 1), on the basis of an aerial

survey done November 5, 1985. On the same survey, 85 deer were seen in parts of Todd Creek that are free of deer in winter.

Although the number of mule deer using the reservoir area all year long is fairly high, observations for this study suggest that summe numbers are supplemented in number by an influx of mule deer in late fall, usually early December. Observations in the area over a number of years indicate that the Todd Creek valley, except for its lowest portions, is used only as summer range by mule deer. Deer remain in those summer ranges throughout the hunting season, but disappear by early December. Mule deer summering along Todd Creek are thought to move east to the valley of the north fork of the Oldman River, although no deer have been marked and followed to confirm this hypothesis. Trails confirm that at least some of those deer move into the river valley above the reservoir area (W.A. Elton pers. comm.). However, it is impossible to say how many of the mule deer summering on Todd Creek spend their winters in the reservoir area in the absence of information from marked deer.

Greater numbers of mule deer were observed in the reservoir area in 1985-86 than in 1984-85. As a result, the estimated number of deer is also higher. That means that there may or may not be more mule deer wintering in the reservoir area this year than last year, but there are unlikely to be fewer. Estimates of the number of mule deer in the area were made by combining the maximum numbers of animals seen in each of the wintering areas listed earlier. The estimates allowed for the possibilities of movement between areas and failure to see all animals on surveys. The estimates should not be considered to be scientifically reproducable, statistically significant results. Rather, they represent the judgement of the study team in response to all the data collected. Even if the numbers of deer had remained stable,

the greater familiarity of the study team with the area and with the specific locations that are likely to harbour deer could result in increased numbers of deer observed. Other factors known to cause variable results in aerial surveys are weather conditions, light, snow cover, vegetation, and flight techniques (Connolly 1981b). There is no way to calculate a variance when total count surveys are attempted in highly variable terrain.

The white-tailed deer estimate in 1984-85 resulted from landowner interviews and was included even though no white-tailed deer were observed in the reservoir area during aerial or ground surveys (Allison and Russell 1985). Two surveys and ground reconaissance in the winter of 1985-86 also failed to locate white-tailed deer in the area of the reservoir (Table 1). Although a few white-tailed deer do use the reservoir area as summer range, we concluded that it is not winter range for that species.

In contrast to 1984-85 (Allison and Russell 1985), the current study resulted in no observations of white-tailed deer above the reservoir along the Castle River. However, observations of landowners (B. Zoratti pers. comm. 1986) confirm the presence of white-tailed deer in the vicinity.

The numbers of fawns found in a population of mule deer in late winter is considered to be one indicator of likely population trends. Low ratios of fawns to adults in late winter have been shown in several localities to be characteristic of declining herds. In one herd in interior British Columbia, spring ratios below 33 fawns per 100 adults were thought to indicate low fawn survival (Connolly 19^1b). In the present study, classification counts resulted in a high spring ratio of 64 fawns per 100 adults. There are no long term data in Alberta that can be used for comparative purposes.

The Willow Valley Trophy Club, an organization of local sportsmen, began to conduct annual counts of wildlife in the area in 1962 by walking through wintering areas of game species. Since 1968 they have surveyed two areas. Both these locations are west of the river valley; one, Burmis-Lundbreck, overlaps with part of the foothills winter ranges surveyed in the present study; the other, Willow Valley, is on Todd Creek 4 km above the study area. Although there are several sources of variation in the data including date, weather conditions, and number and skill of observers, the data on deer collected by the club (Table 4) suggest some interesting ideas in relation to the present study.

The Trophy Club data suggest that there have been two area-wide decreases in numbers of mule deer in the area since they began keeping records: in 1971-72 and 1983-84. In addition, they recorded a decline in Willow Valley in 1967-68. The low numbers recorded in Burmis-Lundbreck in 1977 appear from surrounding data to be a sampling error. The Club saw about half as many mule deer in their 1972 survey as they did in their 1971 survey. They noted that the weather was harsh in winter 1971-1972. In Montana, mule deer suffered extensive winter mortality that same year (Hamlin et al. 1984). However, the Willow Valley data suggest that the local populations may have recovered more quickly than those in Montana, as record high numbers for the club were recorded in 1974. Numbers observed fluctuated, but remained generally high until 1983, when they were again much lower than previous years. The cause of that most recent decline is unknown. In 1984 and 1985, numbers again appear to climb (Table 4). The 1967-68 decline can likely be attributed to a severe late winter storm in April 1967, after the survey had been completed. The storm killed hundreds of cattle throughout the municipality, and it seems reasonable to suggest that deer also died.

Table 4. Willow Valley Trophy Club Annual Game Survey Results: 1962-1986.

YEAR	WILLOW VALLEY AREA		BURMIS-LUNDBRECK AREA	
	mule	white-tailed	mule	white-tailed
1962	220	0	-	-
1963	292	0	-	-
1964	141	0	-	-
1965	131	0	-	-
1966	253	7	-	-
1967	257	0	-	-
1968	173	0	150	30
1969	182	0	297	32
1970	175	0	129	0
1971	318	0	255	0
1972	152	0	147	42
1973	182	7	179	4
1974	359	31	232	98
1975	376	14	312	55
1976	332	7	233	40
1977	408	16	101	6
1978	376	40	380	37
1979	365	4	439	50
1980	376	0	210	4
1981	430	0	270	8
1982	405	1	290	41
1983	248	17	144	46
1984	101	30	232	58
1985	192	15	300	74
1986	270	26	327	18
range	101-430	0-40	101-439	0-98
mode	270		233	

To the extent that the Willow Valley Trophy Club data can be generalized to the study area, they suggest that numbers of mule deer are currently not at numerical extremes - neither very high nor very low - and they may be increasing. The supposition of a possibly increasing population is supported by the high survival of the 1985 cohort to late winter of 1986 (data from this study), and the Trophy Club's 1986 information.

White-tailed deer have expanded their ranges in the study area in relatively recent years. Records of the Willow Valley Trophy Club (Table 4, S. Kubasek pers. comm.) suggest that white-tailed deer first entered the area in the late 1960's and early 1970's.

2. Use of Habitat by Mule Deer And White-Tailed Deer in the Study Area

The observations of mule deer in various habitat types were presented earlier (Table 2). Habitat types available to the deer in the reservoir area were calculated by combining two tables (Tables 1 and 2 from Hardy and Associates (1978) Ltd. 1986) of habitat types calculated from the vegetation maps for the reservoir area and for the area above full supply level. Because mule deer are so mobile, and use relatively large areas, it was considered useful to look at the entire range of vegetation types available to them. Table 2 from the present report is reproduced again here. Following the table we present a second table reproduced from the vegetation report that shows the percentages of habitat types above and below full supply level and our calculated total percentages in the entire area.

Table 2 was built from analysis of maps and habitat notes collected for the present study. When deer observations were classified for habitat according to the vegetation photomosaic only, without reference to our own notes, it is clear that the shrub types (2A and 2B) are underrepresented on the map, while grasses (1A) are over-represented. Some minor differences were apparent in the use of cottonwoods and conifers. However, we consider the figures presented in Table 2. more accurate, as the map delineations on the vegetation mosaic were not fine enough for the

Table 2. Percentage of Mule Deer Observations in Various Habitats

HABITAT TYPE	WINTER 84-85	WINTER 85-86	FALL 85	SUMMER 85
1A Western wheat grass	33	34	36	31
1B rough fescue	2	3	Ø	3
2A shrubs - berry type	13	3Ø	3Ø	19
2B shrubs - juniper	6	13	5	9
3 cottonwood	3	5	2Ø	18
4 aspen	1	4	1	7
5 limber pine	5	Ø	Ø	3
6 Douglas fir	4	8	9	5
C cultivated	33	2	Ø	5
TOTAL NO	732	1638	528	297

Table 5. Percentage of Habitat Types Available in the Reservoir and Vicinity*

HABITAT TYPE	RESERVOIR AREA	OUTSIDE RESERVOIR	AVERAGE
1A	57.3	46.2	48.7
1B	1.8	Ø.4	Ø.7
2A	3.Ø	1.4	1.8
2B	3.8	Ø.5	1.2
3	14.7	Ø.Ø	3.1
4	Ø.4	Ø.4	Ø.4
5	-	Ø.1	Ø.4
6	2.4	Ø.7	1.1
C	16.3	49.9	42.9

* Data from Hardy and Associates (1978) Ltd. (1986) and include those areas mapped by them only. Habitat types other than 1A and C should be considered minimum numbers as in the present study some errors were found in the photomosaic.

purposes of this study. The representation of mule deer use of Douglas fir habitat is probably low because of the poor visibility of deer in those areas.

Comparing the data on observations of deer within different habitats with habitat types available inside and outside the

reservoir area suggests, as one might expect, that the shrubby habitats are selected by deer, as are the areas of Douglas fir. Interestingly, mule deer appeared to be seen in the cottonwood habitat type (3) more in summer and fall than in winter. By contrast, all white-tailed deer observed in winter were in either cottonwood or grassland areas. A factor of importance in comparing the habitats available above and below full supply level of the reservoir is that the types of habitat selected by deer (that is the habitat types in which percentage of deer observations was greater than the percentage of land covered by the habitat) in all seasons are more available below the full supply level than above it. If widespread slumping above full supply level occurs, it is our impression that habitats preferred by deer will again be selectively removed. The Hardy and Associates (1986) data clump vegetation information in two classes: above full supply level and below. However, the area within the study area above full supply level includes parts of the river valley that will not be flooded, valley walls above the full supply level, and upland areas. Much of the brush listed by Hardy and Associates (1978) Ltd. (1986) in the "above full supply level" category will actually be found within the river valley. If slumping occurs, increased loss of deer habitat will occur.

Connolly (1981b) stated that numbers of mule deer in an area are ultimately limited by the quantity and quality of their habitat. Browse counts, however, leave much to be desired as an indicator of deer population trends. Intensity of use of critical winter range can change independently of deer numbers. Use of key areas by deer is not necessarily proportional to population size. When deer numbers are low, almost all the deer may be found in preferred areas. Habitat analysis and determination of carrying capacity are complex problems, as discussed later, that have not yet been satisfactorily solved in any given area.

3. Importance of Weather and Food to Mule Deer in the Study Area.

The study area and surrounding parts of southern Alberta have suffered lower than normal rainfall for four years. The summer of 1985 in the study area was the driest on record (Pincher Creek Weather Office pers comm. 1986) until August. During August and September, the study area received 305 mm of rain, which allowed fall regrowth of grasses, berries and shrubs. Drought is known to be one of the most important factors affecting the quality of plains wildlife habitats (Severson 1981). It normally has its greatest influence on winter diets of ungulates and its least on spring diets (Stephenson et al 1985). In the study area, the late summer rains likely prevented the effects of the drought from impinging seriously on the mule deer in the winter of 1985-86. The decreased use of croplands by mule deer in 1985-86 in comparison with 1984-85 seemed to compensated by increased use of green plants under the snow in shrub - type habitats (Table 2). That does not mean that we can conclude that the deer ate more shrubby browse in winter 1985-86 than 1984-85. Levels of browsing did not change appreciably from one winter to the next (Table 3).

In 1984, a seriously dry year in the study area, several farmers did not harvest crops of barley or hay because they considered the crop too thin to be worthwhile. The mule deer took advantage in particular of standing crops of barley as winter feed (Allison and Russell 1985). Although 1985 was drier, area landowners salvaged crops on cultivated acreage by cutting or grazing them. As a result, there were fewer gleanings for the deer, and their movements seemed to change accordingly. Deer were much less frequently observed on stubble in 1985-1986 than in 1984-1985 (Table 2). The 1985 fall regrowth of native grasses and browse

appeared to provide an adequate maintenance ration during 1985-86.

Areas dominated by grasses are recognized as important feeding areas for mule deer. Draws and other shrubby adjacent areas are heavily used by them (Mackie 1970). The literature notes that agricultural crops may be used heavily by deer in winter, particularly alfalfa (Severson 1981). In spring, mule deer occupy south-facing slopes to feed on the first green vegetation and will also graze on winter wheat, particulary if the field is close to rough terrain (Severson 1981). These observations from the literature are confirmed by study results in both years.

By late February 1986, the snow cover had disappeared and green plant material was uncovered. Observations made during the study suggest that movements of mule deer at that time were influenced by the availability of green feed which occurred unusually early. Early appearance of green vegetation in the river valley was followed by extremely early return of some mule deer to their summer ranges (first observation March 22, 1986).

Extensive cottonwood floodplains on prairie rivers are maintained and allowed to develop only by the shifting nature of the streambed (Severson 1981). The implications of this are that, even outside of the reservoir area, anywhere the gradient or flow of the rivers are affected by the dam, habitat for both species of deer may be reduced. White-tailed deer in particular were observed in winter in relatively wide, flat sections of riverbottom supporting extensive cottonwood forests above and below the reservoir.

The drought affecting the study area in summer also resulted in both winters having low snowfall and frequent warm winds. Accumulation of snow was generally insufficient to impede move-

ments of deer, and crusting was not so severe that cratering was precluded. Therefore the deer were always able to forage on ground plants as well as browse. On February 16, 1986 the study area received 53cm of soft snow, and the temperatures fell as low as -35 C. By February 20, the snow had settled to 42cm (Pincher Creek Weather Station, pers. comm. 1986). At that time the final aerial survey of the year was done. Deer and their tracks were easy to see. Neither mule nor white-tailed deer had moved into areas unoccupied during more open parts of the winter and cratering in the snow was common. Tracks indicated that movements of the deer in the three days since the storm had remained localized, but when disturbed by the helicopter, the deer could easily bound through the snow. On February 20, the survey was cut short by heavy winds and blowing snow; that was followed by complete melting of the snow cover and flooding of the rivers on February 24. It was therefore not possible to determine how the deer would respond to an extended period of deep snow. Loveless (1964) reported that snow 10 to 12 inches deep (25 to 30 cm) impeded mule deer movements and 20 to 24 inches (51 to 68 cm) effectively precluded use of an area in central Montana.

Weather conditions that affect populations of mule deer often do so because of their indirect effects on availability or quantity of forage. Starvation and malnutrition may result from deep and prolonged snow cover that prevents access to food. Even relatively small amounts of snow may hamper movements of animals and limit access to food under it - when a heavy crust is formed, for example (Connolly 1981b). If, as suggested above, the total energetics of the winter situation is critical, shelter from the wind will be important in minimizing heat losses from animals in winter. Microclimates chosen by mule deer in the study area, where strong winds are common, could be shown to be significantly warmer than exposed locations because of the presence of trees or

brush and topographic shelter from the wind.

Observations of cratering and browse use in the present study suggest that mule deer are catholic in their food habits. During the winter of 1984-85, deer browsed on dried and frozen leaves that remained attached to poplar, buckbrush, silverberry, and alder. Craters in the snow revealed the use of creeping juniper as well as grasses, forage crops and unharvested grain. In addition, in areas offering shelter from inclement weather, use of browse was heavy, particularly saskatoon and red osier, although silverberry and rose were also used (Allison and Russell 1985). Tips of Douglas fir were also browsed. Geist (1981) observed heavy feeding on fallen leaves of poplar, snowberry and other species. The leaves are preferred on the stalk, but are also picked up from the ground. Browsing on twigs was generally confined to periods of heavy snow (Geist 1981). In the winter of 1985-86, the pattern was similar to 1984-85, except for an apparently minimal reliance upon agricultural crops that we attribute to two factors. First, because summer weather in 1985 was even harsher that 1984, almost all cultivated acreage was harvested by cattle grazing or put up as forage. Second, regrowth of grasses in fall enabled the deer to rely on open grasslands nearer to the valley for much of their food. These observations of mule deer food habits are confirmed by reports of Martinka (1968) and Geist (1981).

Food supplies are important and may limit populations of mule deer, but deficiencies will normally be qualitative rather than quantitative. Even preferred forage species may not provide an adequate ration in winter (Connolly 1981b), meaning that the fat and protein reserves of the individual in combination with winter severity and length may ultimately determine survival (Torbit et al. 1985). Good nutrition in a population is usually indicated by

good physical condition and body weight; high reproductive rates, especially breeding success of young does; high survival rates of fawns; and increasing numbers in the population (Connolly 1981).

4. Importance of Topography and Cover to Wintering Mule Deer.

In contrast to white-tailed deer, mule deer were found in more rugged sections of the valley, like those to be included in the reservoir where the cottonwood stands are not large. Winter range of mule deer is characterized by rough terrain rather than the presence of specific types of vegetation (Severson 1981)

Mule deer were observed sheltering in vegetative cover, such as Douglas fir as well as in thick deciduous brush. Severson (1981) remarked that north facing slopes with coniferous trees provide some of the best cover for mule deer on the plains. Use of plains habitats by mule deer often appears to center on cover requirements rather than food. Cover is important for shelter from wind and weather and escape from predators. Where deer feed and rest is largely a function of weather. During wind they find and stay in pockets of calm, such as below the crests of hills and in dense forest (Geist 1981). The availability of food could become critical under conditions of drought, heavy snow, and intensive livestock use (Severson 1981). None of those possibly-limiting conditions seemed to be influencing deer numbers during the period of the study.

Winter presents the greatest nutritional challenge to deer. Winter ranges are important in providing small amounts of energy and protein to wild ruminants. However, it is probable that winter ranges will always be incapable of meeting nutritional requirements, and they should be viewed as holding areas for deer

until summer ranges become available (Torbit et al. 1985). Length of occupancy of winter range may then be the critical factor (Wallmo et al. 1977, cited by Torbit et al. 1985). Animal condition, as represented by both fat and protein stores, will dictate length of time that deer can occupy winter ranges. These reserves in effect 'buy time' for deer as a buffer against winter (Torbit et al. 1985)

Topographic features are important to mule deer. Rough and steep terrain is a principal feature of mule deer range. The configuration of coulees and their orientation to prevailing wind are important in determining the relative accessiblilty of areas to deer and the extent to which snow will collect (Severson 1981). In the study area, coulees that provide little cover during winters of low snow and frequent melting may be the same areas deer rely on under conditions of deep and drifting snow.

Water is another important and potentially limiting feature of mule deer habitat. The addition of small bodies of water in selected localities may improve habitat by increasing the availability f water. However, large bodies of water can result in habitat loss and may act also as barriers to daily or seasonal movements. Drownings of animals occur during attempts to cross reservoirs (Reed 1981).

When mule deer are disturbed they move into escape terrain. Geist (1981) stated that they move uphill. However, in the study area (more a plains than a mountain habitat), they move onto the walls of the river valley either up or down, away from the area of disturbance. This need for escape terrain means that the systems of coulees and the valley itself are of great importance to the mule deer for more than food and cover. Even apparently suitable habitat will not be occupied if appropriate escape terrain is not

available.

Individuals will remain in one home range all year long if weather conditions do not force them to abandon it. Geist (1981) referred to deep snow as the condition most likely to cause abandonment. In the study area some ranges used only in summer lack both topographic and vegetative shelter. In this regard, Geist (1981) stated that in the higher latitudes and altitudes forage resources in winter become less important than microclimates as factors in balancing energy and nutrient budgets, although food must be available. Geist also commented that a prerequisite for the exploitation of rich forage resources is access to localities providing shelter from harsh weather and permitting escape from predators. Areas used for both escape and shelter must provide adequate forage to supply the needs of individuals that may be forced to stay there for long periods. (Geist 1981).

5. Importance of Mortality to Mule Deer

In mortality studies of mule deer done elsewhere, coyotes have been found to prey heavily on fawns. In the study area, coyotes were observed to be plentiful during the winter of 1984-85 (Allison and Russell 1985), but were much less numerous in 1985-86 (Appendix 2). Despite high production of fawns and great variability from year to year, mortality of fawns during summer averaged 32% in a Montana study. Ninety percent of marked fawns that died were killed by coyotes. Mortality rates of fawns were as high during late summer as in early summer, indicating that coyotes can cause significant mortality among fawns as old as 105 days (Hamelin et al. 1984). No attempt was made in the present study to estimate mortality of fawns or older animals. However, the Montana study (Hamelin et al. 1984) provides some interesting

information on predation as a potential limiting factor on populations of mule deer. In the first two years of the study and for several previous years yearlong fawn mortality was high enough to keep the population at a low level. After fawn mortality decreased in 1977, the population increased. By 1980 it had doubled in density, despite high numbers of coyotes in the area. The authors concluded that coyote predation can reduce fawn survival in a nutritionally healthy population. Without either coyote control or a decrease in the coyote population, summer survival of fawns increased to 96% in one year when microtine populations were high. This complex situation suggests that the availability of alternate prey has a large impact on coyote predation rates. The importance of various prey species likely varies over time and by area and should be determined locally (Hamelin et al. 1984).

Coyotes are a major cause of fawn mortality, but are also capable of killing healthy adult deer. The most vulnerable deer are taken. Vulnerability is a function of physical, biological and ecological factors (Connolly 1981b). Connolly (1981b) remarked that predation by coyotes on mule deer has never been documented as the principal cause of a decline, although the study by Hamelin et al. (1984) showed that predation on fawns could prevent an increase. In 1984-85, the study team examined those coyote scats it encountered in winter. Most contained deer hair (Allison and Russell 1985). However, it was not possible to determine whether adult deer in the study area were being killed by coyotes. Despite extensive ground surveys of the study area in both winters, no fresh carcasses were found.

Predation by man (hunting) may potentially limit populations of mule deer. That is unlikely to be occurring in the study area. There is an antlerless season, and the taking of bucks is

restricted to "trophies" only - that is bucks having three points or more on each antler. It is our impression, confirmed by local people (G. Mowat pers. comm. 1986, D. Olsen pers. comm. 1986) that the imposition of a trophy buck season in the area had the desired effect of increasing the numbers of adult male deer, but apparently also decreased the total hunting effort. As a result, it is thought that few animals were taken by hunters from the population that winters in the river valley.

Where mule deer and white-tailed deer occur together, it is generally agreed that mule deer are more vulnerable to harvest. Burgess (1973, cited by Connolly 1981) thought that white-tailed deer in Alberta may increase and take over mule deer habitat because of an ability to recover from severe winters more rapidly than mule deer. As the population of white-tailed deer increased, they would expand into mule deer habitat before the mule deer could recover.

6. The Carrying Capacity Concept.

The concept of carrying capacity is one that is accepted by wildlife managers and grazing specialists. There is however, some controversy over definition and practicality of the term. Disagreement exists over whether carrying capacity should refer to the maximum number of animals that can be supported on a specific area regardless of the physiological condition of the animals, the population and the range, or whether it should refer to some "optimum" number that can be supported in good physiological and reproductive condition without deterioration of the range. It is in the latter sense that managers of range for domestic animals and wildlife both tend to attempt to manage the land they use. The implications for the managed species of animals are that food

will be available at all times surplus to their requirements for maintenance, and that the population of animals using an area will be lower than the maximum number that could subsist there. The optimum carrying capacity involves relatively stable numbers of animals supported in good condition on a sustained basis. The population will never be allowed to reach a level at which it damages the habitat, crashes and remains at a low level until the habitat recovers to support larger numbers once more. By contrast, the maximum carrying capacity envisages major fluctuations in numbers. It increases when forage production is high or winters mild, and severe readjustment and die offs occur when circumstances change.

Although the concept of carrying capacity is widely accepted, and is used in wildlife management, cattle husbandry, and even in the broad World Conservation Strategy (1980), Connolly (1981b) cautioned that the estimation of carrying capacity is theoretically possible, but has never been achieved. In addition, carrying capacity measurements are usually based on the premise that food is the factor that will limit populations. Actual conditions in any area are so complex, and populations may be held below their theoretical maxima by a so many other factors that such measurements may have little practical application.

For the Oldman River dam and reservoir the implications are obvious. The foregoing discussions have highlighted some of the complexities of the interactions between mule deer and their habitat. Calculations of losses of deer habitat based on some theoretical estimation of food availability or carrying capactiy above and below the reservoir water line may be useful for some purposes. However, attempts to extrapolate that to some number of deer or proportion of the population lost to the dam is not. Further, attempts at mitigation should not be geared solely to

single aspects of the mule deer habitat - such as food.

7. Effects of the Dam and Reservoir on Cervids in the Study Area

Discussion of the effects of the project on cervids in the study area is beyond the terms of reference of this study (Appendix 1). To date no detailed project description, outlining construction times, areas to be disturbed for fill, potential road systems, camp locations, sizes, and dates of occupancy, clearing plans, reservoir filling plans, and other details has been available to allow the preparation of an adequate impact assessment. Allison and Russell (1985) listed some of the probable effects of reservoir development on cervids in the area, as did Young et al. (1986), and those remain valid.

In the present study an attempt was made to look at the Waterton dam and reservoir to determine whether coulees that meet the reservoir are occupied by deer in winter. The part of the Waterton River flooded by the dam supported populations of white-tailed deer. Two days of ground-and-automobile reconaissance suggested that coulees other than Yarrow Creek did not support deer. Yarrow Creek is wide enough and long enough to support wintering deer without access to the river valley. Area landowners report heavy use of the river valley above the reservoir by white-tailed deer (T. Palmer pers. comm. 1986). Use of the valley above and below the reservoir by cattle was also extremely heavy, so browse counts were not attempted. The tentative conclusion is that although white-tailed deer occupy the valley of the Waterton River, the dam and reservoir removed winter habitat, and the remaining coulees were unable to continue to support white-tailed deer in the immediate area of the reservoir. Mule deer do not

occur in the vicinity.

8. Future Work Needs

Work done for the present study plus that accomplished during the previous summer and winter provides information on the cervid populations occupying the reservoir area. Little is currently known of the ecology and population dynamics of mule deer in southern Alberta. The background information now available may provide an opportunity that should be used to do more intensive work on mule deer. For example, there may be extensive interchange of individual animals between the Oldman River population of mule deer and populations along Pincher Creek, upstream on the Oldman River, or those on the large foothills winter ranges.

For purposes relating to the impacts of building of a dam on the Oldman River, detailed studies are unnecessary unless specific statistical comparisons of pre- and post-reservoir conditions are desired by Alberta Environment or form part of mitigation plans. Such detailed studies should be designed in concert with the mitigation work.

Two factors support the maintenance of a low-intensity survey program to keep information on the status of the population current. First, the dam location itself is within a favoured wintering area for mule deer. Impacts on that area have already begun, and will continue throughout the project. Second, it will be several years before filling of the reservoir begins and maintaining current information on the status of the population will be useful and necessary for assessing mitigation measures.

A detailed description of the project plus ancillary

developments such as roads and recreation areas should be used with the data and insights now available on deer populations as the basis for the preparation of an impact assessment plus mitigation and research plans. Any mitigation plans involving the planting of cover or food species could begin immediately.

Marking of deer in the area affected by the reservoir would be one useful tool for helping to determine what happens to individual animals that now use the reservoir area subsequent to its flooding. Impacts will occur throughout the reservoir area from road construction, forest removal and other activities that occur before the area is flooded. If it is to be done, marking should begin soon.

Suggestions for specific mitigation plans were not part of the terms of reference for the present study (Appendix 1). However, some ideas suggest themselves immediately. Contractors working on project-related jobs now should be provided with a small pamphlet detailing the kinds of wildlife to be found in the specific areas they are working, and the ways in which they can make their activities least obtrusive. It would explain, for instance, that there are more than 100 deer that use the river valley in the area of the dam. For project planning purposes, the engineers should be informed of the importance of the three coulees immediately below the dam, and discouraged from removing vegetation from those areas as much as possible. Stands of Douglas fir are important to deer for cover in winter and should also be undisturbed by roads, soil dumps or other ancillary effects of the construction if possible. Preparation of a detailed mitigation plan would include such ideas as well as possible habitat development in suitable locations.

PERSONAL COMMUNICATIONS

W.A. Elton	Rancher, Todd Creek, near study area
L. Gudmundson	Fish and Wildlife Division, Lethbridge Alberta
S. Kubasek	Willow Valley Trophy Club, Pincher Creek Alberta
G. Mowat	Rancher, north of Cowley Alberta
D. Olsen	resident of reservoir area,north of Cowley Alberta
T. Palmer	Rancher near Waterton reservoir, Twin Butte Alta.

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APPENDIX 1

TERMS OF REFERENCE

SCHEDULE E
TERMS OF REFERENCE
Project Basis
Service Agreement
Consulting

This study deals with a section of the 1985 field program of the Overview Phase (1b). This winter ungulate survey is meant to provide additional information to the survey conducted during the period January to March 1985.

OBJECTIVES

The overall objective of the study is to assess ungulate numbers and distribution within the Oldman River dam reservoir site and adjacent areas during the winter of 1985-86. This information will supplement the data obtained in the previous 1984-85 Winter Ungulate Survey to provide complete information for the entire winter season.

Specific objectives of the study are:
1. To determine the species and population size of the ungulates using the reservoir and adjacent areas during the winter.
2. To determine the distribution and movements of these populations.
3. To document fall numbers and distributions of ungulates in summering areas near the river valley, if early fall snowfall permits.

STUDY AREA

The Oldman River damsite is located in the foothills of southwestern Alberta. The attached map (Figure 1) outlines the general location of the proposed reservoir and the location of the dam. The study area includes areas to be flooded, upstream and downstream river valley segments and previous Fish and Wildlife Division survey blocks. Recommended survey blocks are outlined in the attached map (Figure 2). Survey blocks previous flown by the Fish and Wildlife Division include FH-1, FH-2, FH-10, OM-24 and OM-25.

STUDY REQUIREMENTS

1. Aerial surveys are to be conducted to determine ungulate numbers and distribution within the study area during the winter

of 1985-86. If early snowfall permits, the fall numbers and distributions of ungulates in summering areas near the study area should also be documented. Although the primary purpose of these flights will be to locate mule deer and white-tailed deer, observations of other species such as upland birds, furbearers, and raptors should also be recorded.

2. The consultant is responsible for scheduling aerial surveys. The flight schedules will be flexible and should be based on the assessed value of the flight to the study and the occurrence of sufficient snow cover to provide adequate survey conditions.

3. Surveys should be conducted by helicopter to obtain accurate counts; a Jet Ranger 206B, or equivalent, is recommended for the flights.

4. The survey blocks should receive complete coverage. Depending upon the terrain and cover density, several flight lines should be established within each survey block. The survey blocks on the river systems should be divided into segments to provide better detail. Recommendations of divisions are provided on the attached map (Figure 2).

5. The Planning Division of Alberta Environment in Edmonton and the Oldman River Dam Information Office in Pincher Creek will be notified prior to all flights.

6. Ground observations of ungulates within the study area will be conducted at the discretion of the consultant to take advantage of changing weather conditions and observations made during the aerial surveys.

LIASON AND REPORTING

A start-up meeting with Alberta Environment and Fish and Wildlife Division may be required. The consultant should also be prepared to conduct on-site meetings as needed. Telephone or in-person reports will be expected over the course of the field study.

Three copies of the report must be submitted to the Planning Division of Alberta Environment by March 31, 1986. The final report, incorporating changes suggested by the reviewers, is to be submitted within one month of receipt of the review comments. Ten bound copies and unbound original camera-ready copy of the final report will be required. The camera-ready copy should include "xerox" reproducable originals, trasparencies of oversized drawings, and negatives of any photographs used.

APPENDIX 2

OBSERVATIONS ON AERIAL SURVEYS DURING THE STUDY

APPENDIX 2 OBSERVATIONS ON AERIAL SURVEYS DURING THE STUDY

November 5, 1985 Aerial Survey

Helicopter Bell 206B

Observers John Russell
Charles Russell
Start: 11:50
End: 15:40

Weather: The wind at ground level was 15 kph from the west when the survey began. At survey end it had increased to 50 kph. There was 15 cm of fresh snow, and the sky was generally clear and sunny.

Other considerations: The area flown was similar to that surveyed on January 30, 1985 (Allison and Russell 1985), except that portions of Todd Creek, a known summer range, were included.

In some places snow clung to shrubs and trees that the deer were using for cover, lowering the visibility of the animals.

Results: Figure 1, Table 1

Table 1. Observations of November 5, 1985 Survey

BLOCK	MULE DEER	WHITE-TAIL	ELK	MOOSE	COYOTE	BIRD
C-1	48					
C-2	38			3		
OM-24		3				
OM-25a	47				2	1 BALD
OM-25b	57				1	1 BALD
OM-26	42					
OM-27	13	5			1	
OM-28	33					1 GOLD
OM-29	40					
Todd Ck	85					
CR-1	18					
FH-1	69		9	5		
FH-2	33	15				
Totals	514	23	9	8	4	3 eagle

Two hundred sixteen deer were seen in the reservoir area.

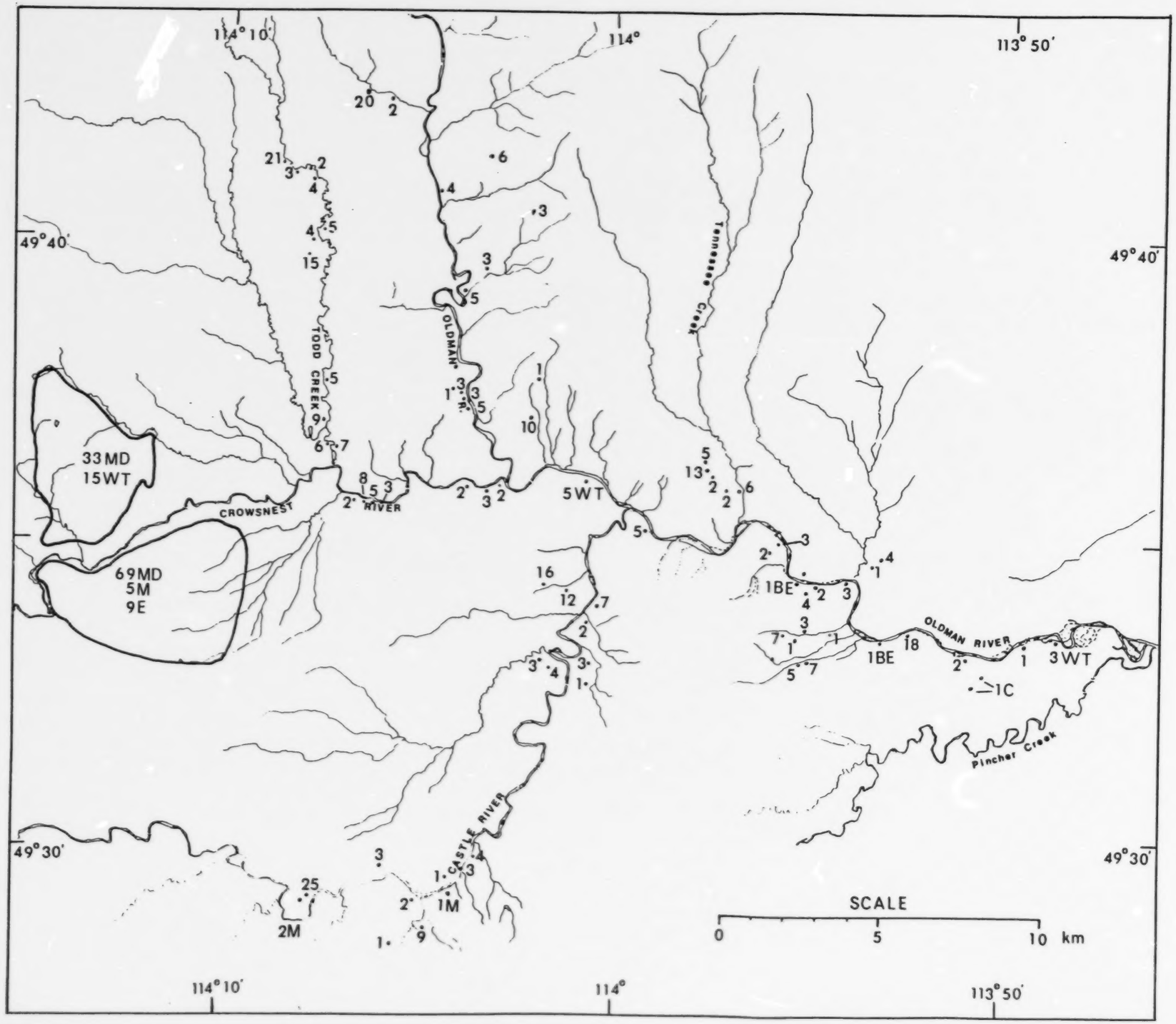


Figure 1. November 5, 1985
Aerial Survey

.	Mule deer
WT	White-tailed deer
M	Moose
E	Elk
C	Coyote
BE	Bald Eagle

January 21, 1985 Aerial Survey

Helicopter Bell 206B

Observers: Lorraine Allison
John Russell
Charles Russell

Start: 10:25
End: 13:00

Weather: The sky was clear and wind 15 kph at ground level throughout the survey. Snow depth varied from 5 to 10 cm and was melting on south facing slopes as the survey progressed.

Other Considerations: Many of the deer were in deep cover during the survey and reluctant to move. As a result our counts for most winter areas were lower than expected. We decided to terminate the survey without covering the foothills blocks FH-1 and FH-2.

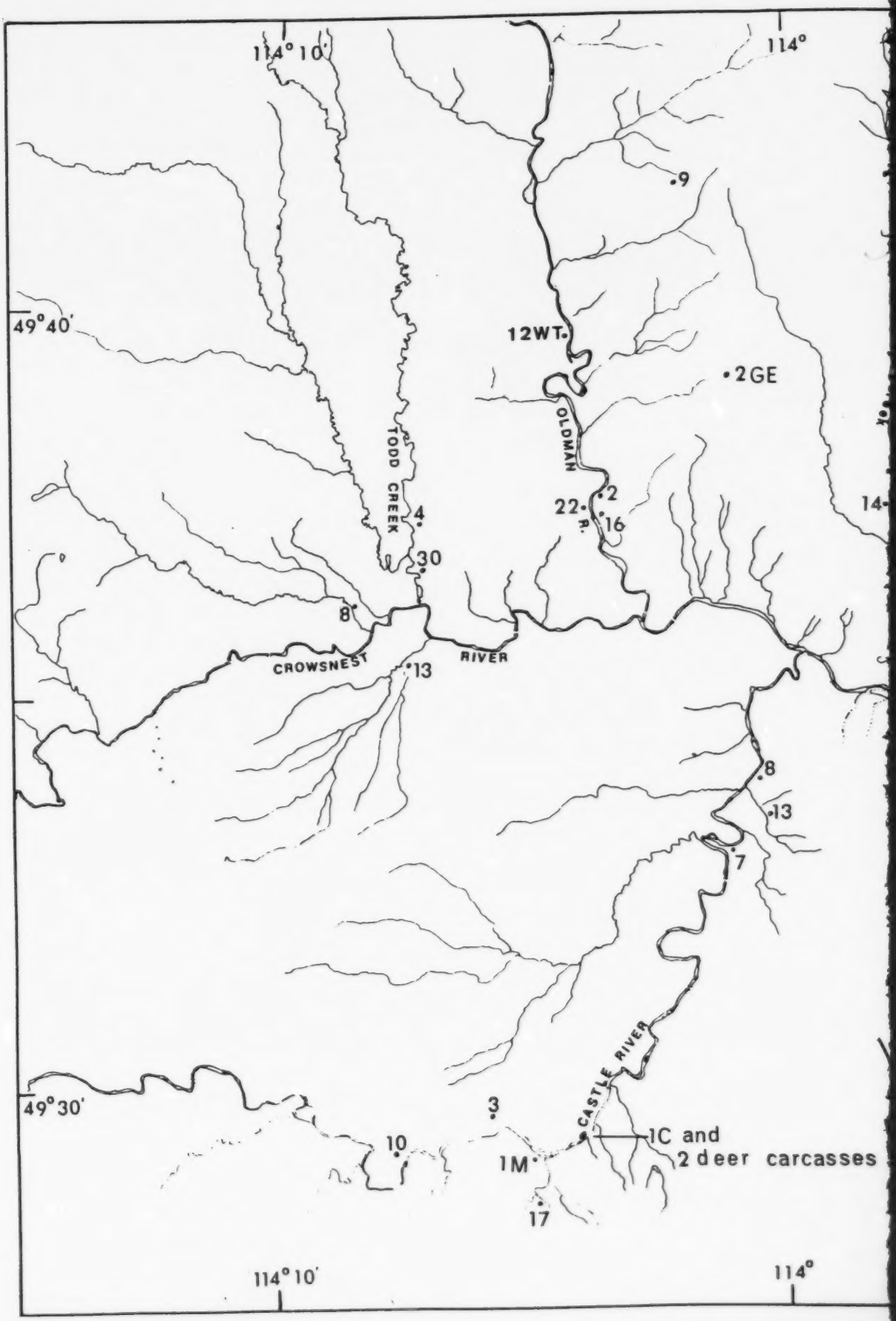
Results: Figure 2, Table 2

Table 2. Observations during the January Survey

BLOCK	MULE DEER	WHITE-TAIL	ELK	MOOSE	COYOTE	COW	DOMESTIC
C-1	49					452	100S*
C-2	27			2	1	243	
OM-24		13					
OM-25a	3						
OM-25b					2	275	
OM-26	66					40	
OM-27						100	4H
OM-28	40					70	
OM-29	9	12				210	
CR-1	55					589	11H
CR-2							
FH-1	23		3	1			
Totals	272	25	3	3	3	1979	115

* Domestic animals are identified S for sheep and H for horses.

Three hundred mallard ducks and two golden eagles were also seen. There were 210 mule deer in the reservoir.


114° 10'
114°
49° 40'
49° 30'
TODD CREEK
OLDMAN R.
CROWSNEST RIVER
CASTLE RIVER
12WT.
2GE
9
4
30
8
13
22
2
16
14
8
13
7
3
10
1M
17
1C and
2 deer carcasses

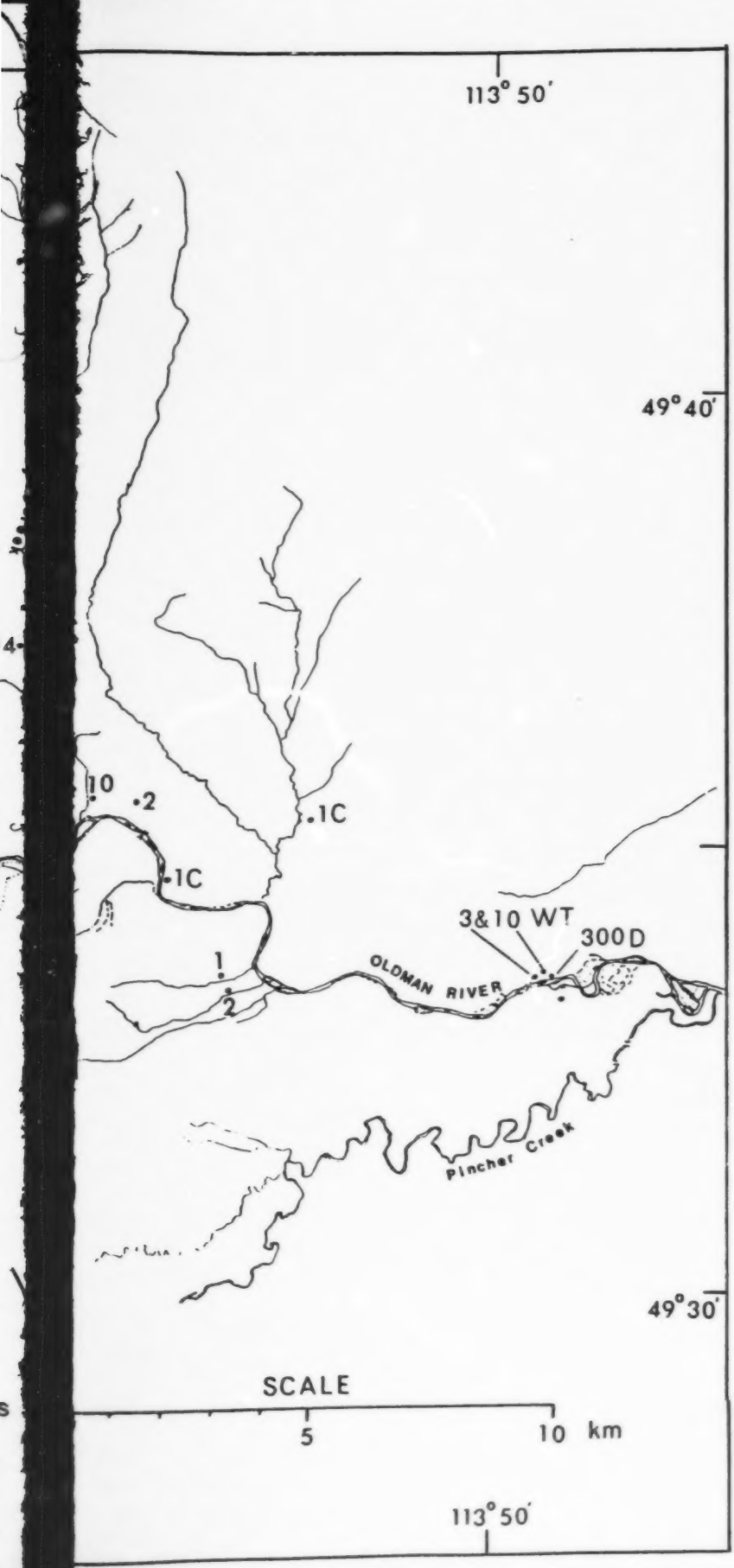


Figure 2. January 21, 1986 Aerial Survey

.	Mule deer
WT	White-tailed deer
M	Moose
C	Coyote
D	Ducks
GE	Golden Eagle

February 20, 1986 Aerial Survey

Helicopter: Bell 206B

Observers: Lorraine Allison
John Russell
Charles Russell

Start: 10:45
End: 13:30

Weather: The survey began with winds of 25 kph and had risen to 60 kph by the time it ended. The sky was clear and 43 cm of settled snow was on the ground. Slight drifting occurred during the flight, and drifting was general above the valley when the flight ended.

Other Consideration: The snow depth seemed to have caused the deer to stay in localized areas since the storm. Tracking was obvious and allowed observers to concentrate on areas that usually contained deer. Spotting conditions were better on this survey than either of the others.

Results: Figure 3, Table 3

Table 3. Observations on February 20 Aerial Survey

BLOCK	MULE DEER	WHITE-TAILED	MOOSE	COYOTE
C-1	91			1
C-2	48		1	
OM-24		64		1
OM-25a	30	23		
OM-25b	55			
OM-26	13			
OM-27	15			
OM-28	54			2
0M-29	19	26		2
CR-1	52			
FH-10	22			
Total	398	113	1	6

Observations of birds included one gyrfalcon, two golden eagles, one bald eagle, a great horned owl and two praire falcons.

Within the reservoir we observed 279 mule deer.

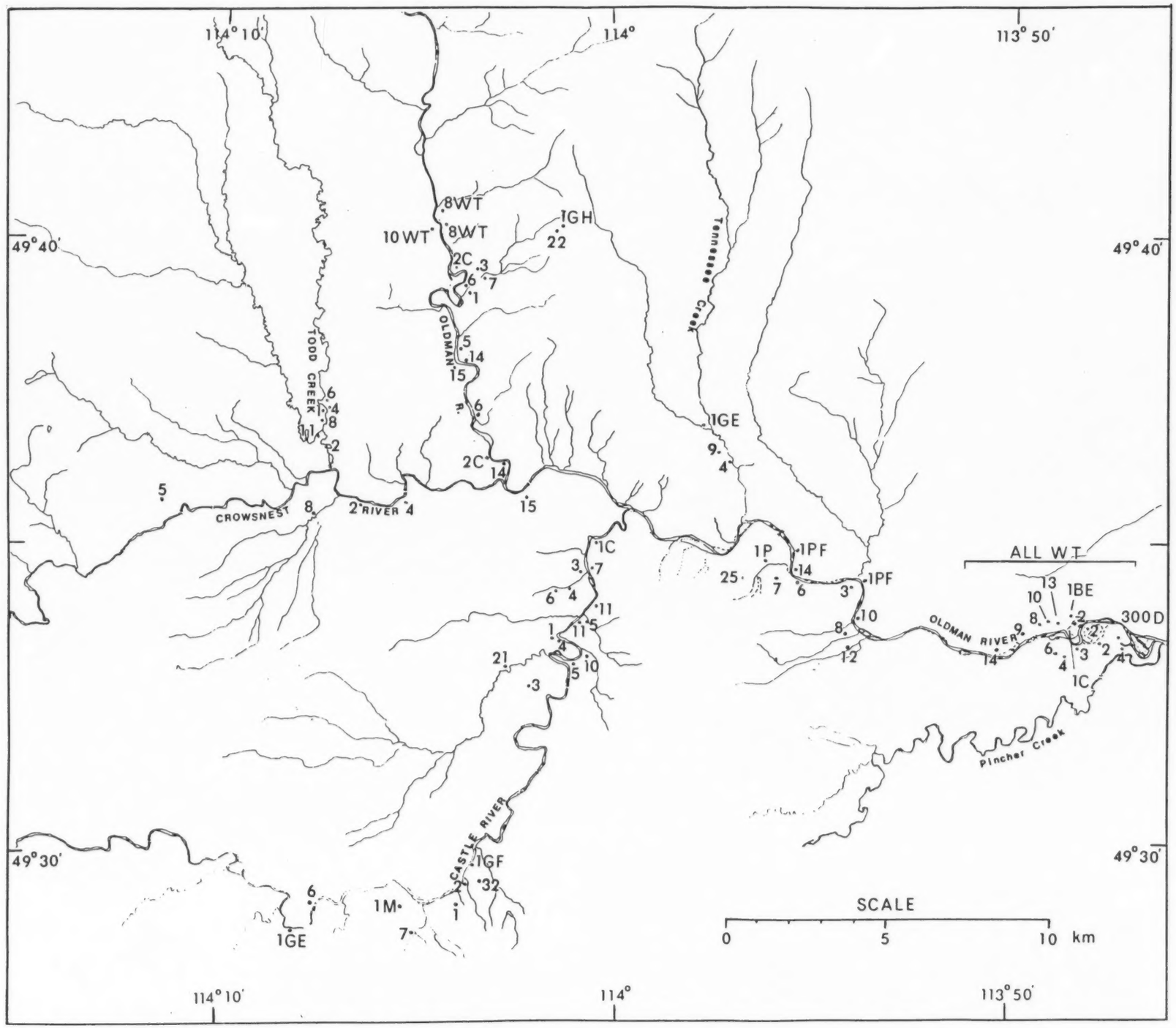


Figure 3. February 20, 1986 Aerial Survey

.	Mule deer
WT	White-tailed deer
C	Coyote
M	Moose
GF	Gyrfalcon
PF	Prairie Falcon
BE	Bald Eagle
GE	Golden Eagle
D	Ducks
P	Porcupine
GH	Great Horned Owl

APPENDIX 3

COMMON NAMES AND SCIENTIFIC NAMES USED IN TEXT

APPENDIX 3. COMMON NAMES AND SCIENTIFIC NAMES USED IN TEXT

MAMMALS

mule deer	Odocoileus hemionus
white-tailed deer	Odocoileus virginianus
moose	Alces alces
elk	Cervus elaphus
coyote	Canis latrans

BIRDS

bald eagle	Haliaeetus leucocephalus
golden eagle	Aquila chrysaetus
gyrfalcon	Falco rusticolus
prairie falcon	Falco mexicanus
mallard duck	Anas platyrhyncus
great horned owl	Budo virginianus

PLANTS

western wheat grass	Agropyron smithii
June grass	Koeleria macrantha
rough fescue	Festuca scabrella
Parry oat grass	Danthonia parryi
Saskatoon (service berry)	Amelanchier alnifolia
silverberry (wolf willow)	Elaeagnus commutata
choke cherry	Prunus virginiana
red osier	Cornus stolonifera
rose	Rosa spp.
hawthorn	Crataegus sp.
creeping juniper	Juniperus horizontalis
ground juniper	Juniperus communis
cottonwood	Populus angustifolia
	Populus balsamifera
aspen	Populus tremuloides
Douglas fir	Pseudotsuga menziesii
limber pine	Pinus flexilis